# Memphis Depot
# Environmental Restoration Program

## Frequently Asked Questions
## Zero-Valent Iron

1. **What is Zero-Valent Iron?**

   Zero-Valent Iron (ZVI) is one of the remedial technologies selected to clean up solvents in the groundwater on the western side of Dunn Field. ZVI has been used to treat solvents in the groundwater in a treatability study on Dunn Field and in an early implementation on Memphis, Light, Gas and Water (MLGW) property northwest of Dunn Field.

2. **How does it work?**

   ZVI is a natural material similar to iron filings or powder. It acts as a catalyst to breakdown the chemicals in groundwater – such as the solvents known as chlorinated volatile organic compounds (CVOCs) that are present in the groundwater at the Depot – into safe compounds. This chemical reaction is called reductive dechlorination.

3. **Will the reaction of the iron with the solvents cause the formation of any other chemicals?**

   The Record of Decision (ROD) for Dunn Field provides a complete analysis of the remedies chosen for Dunn Field. Each remedy and technology was thoroughly evaluated for safety and efficacy – including the potential for reactivity or the creation of undesirable breakdown products – and has been approved by the EPA and TDEC.

   A pilot study that was completed at the Depot in April 2004 showed that Zero Valent Iron (ZVI) injection effectively reduced solvents in the groundwater by an average of 95 per cent. The formation of other chemicals, known as byproducts, did not occur.

4. **What happens if the iron comes in contact with other chemicals other than CVOCs?**

   The Record of Decision (ROD) for Dunn Field provides a complete analysis of the remedies chosen for Dunn Field. Each remedy and technology was thoroughly evaluated for safety and efficacy – including the potential for reactivity or the creation of undesirable breakdown products – and has been approved by the EPA and TDEC. In addition, pilot studies have been conducted to ensure these remedies will be safe and effective under the environmental conditions at the Depot.

5. **How do we know this treatment is safe?**

   ZVI is a food-grade powdered iron product that has been used to treat groundwater impacted by CVOCs since the early 1990s. The Environmental Protection Agency (EPA) considers it to be a safe substance that presents no unacceptable risks to human health or the environment.

   The Record of Decision (ROD) for Dunn Field provided a complete analysis of the remedies chosen for the Depot, including a review of their performance at other cleanup sites. Each remedy was thoroughly evaluated for safety and efficacy and has been approved by the EPA and TDEC. In addition, pilot studies have been conducted to ensure these remedies will be safe and effective under the environmental conditions at the Depot.

6. **Why did you decide to use this technology at the Depot?**

   ZVI is recognized by the EPA as a cost-effective and reliable technology to treat groundwater impacted by chemicals such as the solvents known as volatile organic compounds (VOCs) in the groundwater at the Depot. At many sites, the use of ZVI is replacing the more traditional pump and treat systems as the preferred method for addressing environmental conditions in groundwater.

   The Dunn Field Record of Decision (ROD) provides the justification for the preferred cleanup remedies chosen at the Depot. Each remedy was selected to ensure the site meets health protective standards for the designated future reuse.

7. **How do you know this technology will work here?**

   ZVI has been used effectively at sites around the world since 1991. A pilot study that was completed at the Depot in April 2004 showed that Zero Valent Iron (ZVI) injection effectively reduced solvents in the groundwater by an average of 95 per cent.

**8. What happens if it doesn't work?**

A pilot study that was completed at the Depot in April 2004 showed that Zero Valent Iron (ZVI) injection effectively reduced solvents in the groundwater by an average of 95 per cent. Based on those results, and the performance of ZVI at other sites around the world, the BCT is confident that ZVI will work effectively at the Depot.

The Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC) will review the effectiveness of this remedy at five-year intervals to ensure the site continues to be safe for community reuse.

**9. What's the difference between ZVI injection and a PRB?**

ZVI injection involves using pressurized nitrogen to inject ZVI directly into the groundwater through a small number of boreholes drilled through the ground. This allows us to go to specific areas where we know we have high concentrations, and actively treat the groundwater within a radius of approximately 40 feet.

A Permeable Reactive Barrier (PRB) is created by injecting ZVI encased in gel through a series of boreholes spaced approximately five to 15 feet apart. A PRB up to 1,000 feet long will be installed on MLGW property west of Dunn Field and will create a treatment barrier or zone that will treat groundwater as it moves naturally through the area.

**10. Will this treatment clean up all of the environmental impacts in this area?**

The nature and extent of environmental impacts at the Depot, and an assessment of possible risks to human health and the environment, are documented in Remedial Investigation (RI) for the Main Installation and Dunn Field. The Records of Decision (ROD) for Dunn Field provides a complete analysis of the remedies chosen for the Depot and the contaminants to be addressed in the cleanup.

A pilot study that was completed at the Depot in April 2004 showed that Zero Valent Iron (ZVI) injection effectively reduced solvents in the groundwater by an average of 95 per cent. The remaining low concentrations of solvents will be treated through monitored natural attenuation with long-term monitoring to ensure that these remedies are effective.

**11. Can ZVI get into the drinking water?**

ZVI will be used at the Depot to treat groundwater in the shallow aquifer, which is located 80-100 feet below the ground surface. ZVI will not impact the City's drinking water, which comes from the Memphis Sands aquifer located approximately 250 feet below the surface in the Dunn Field area. Once ZVI is in the ground, the iron particles will bind with the soil and return to its normal state through a natural process called oxidation.

**12. Is the drinking water safe?**

The drinking water is safe. The affected groundwater is in the shallow aquifer, which is not used for drinking. The drinking water in Memphis comes from the Memphis Sands aquifer, which has not been affected by historic activities at the former Memphis Depot. In the Record of Decision, we have identified areas within the shallow aquifer that require cleanup to reduce the potential risks of exposure and to meet the cleanup objectives outlined in the Record of Decision. We are now in the process of designing and implementing the technologies that will reduce or eliminate these chlorinated solvents from the groundwater, and ensure the future safety of this site for the intended re-use.

**13. How long will it take before the groundwater is clean?**

We have completed several major steps in the cleanup process, which is governed by the Comprehensive Environmental Response & Liability Act (CERCLA). The CERCLA process involves six stages. We will be in the second to last stage, Remedial Design, at all sites by spring of 2006. At some sites, we will have completed our cleanup by that time. Others will take longer to complete. Following the Remedial Action, we will continue to monitor the remedies at these sites to ensure continued effectiveness in protecting the health and safety of this community. In some cases, this monitoring will continue indefinitely.

**14. Was the public notified prior to the start of this cleanup action?**

The environmental cleanup program at the Depot is being conducted according to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which includes specific guidelines for community involvement, including opportunities for public review and comment. The Depot's Community Relations Office has met all of these guidelines, and implemented additional

opportunities over and above the guidelines to provide information and seek public input as part of our comprehensive Community Involvement Plan (CIP).

In addition to regular fact sheets and articles in our community newsletter, EnviroNews, which are sent to our mailing list of more than 5,000 addresses, information about each stage of the cleanup program is presented and discussed at the Depot's Restoration Advisory Board (RAB) meetings. These meetings are open to the public and advertised in three community newspapers. Cleanup options being evaluated for use at the Depot were also presented for public comment at an official Public Comment Meeting as part of the Proposed Plan phase of the CERCLA process.

If you would like more information on our cleanup program, or would like to be added to our mailing list, please contact the Depot's Community Relations Office at (901) 774-3683.

**15. How long will that iron stay in the ground? Could it move off site and into the community?**

ZVI is considered a safe substance that presents no unacceptable risks to human health or the environment.

The pilot study we conducted demonstrated that ZVI continues to treat contaminated groundwater that flows into the injection area for an estimated 12 to 18 months after injection. Once ZVI is in the ground, the iron particles will bind with the soil and eventually break down through a natural process called oxidation.

**16. What are you going to do to reduce the noise during your work on Dunn Field?**

The Depot's environmental contractors will make every effort to minimize disruption to the community during the cleanup activities. More information about these efforts will be included in the remaining Remedial Designs that will be completed for the cleanup remedies at Dunn Field. These will be presented to the public for review in the spring of 2006.

**17. I read a story in the Commercial Appeal about enhanced bioremediation. Is that the same as ZVI?**

No, they are two different cleanup technologies that have been approved for use at the Depot.

Enhanced bioremediation is one of the technologies approved as a remedy for groundwater at the Main Installation. It involves injecting natural-source nutrients that feed organisms already in the environment. These organisms help to naturally break down or degrade certain chemicals. By encouraging the growth of these organisms, we can effectively speed up this process, which is known as enhanced bioremediation.

ZVI is a food-grade powdered iron product that has been used to treat groundwater impacted by CVOCs since the early 1990s. The Environmental Protection Agency (EPA) considers it to be a safe substance that presents no unacceptable risks to human health or the environment.

**18. Is there a possibility you might find more Chemical Warfare Materiel while you're working on Dunn Field?**

In 2001, the environmental team completed an early removal action for chemical warfare materiel (CWM) at Dunn Field. During that project, we removed all CWM related materials that were identified in the historical records at the former Memphis Depot. In addition, we conducted a Pre-Design Investigation at the former disposal area on Dunn Field. Based on those two investigations, we do not expect to find any additional CWM material.

Our field crews are trained to identify the nature of the waste that is discovered throughout the cleanup process. A site safety plan will be completed and approved by the EPA and TDEC as part of the Remedial Action work plan, and our environmental contractors will take all appropriate safety precautions to protect the community.